

**HYDROMODIFICATION MANAGEMENT  
STUDY FOR  
MEADOWOOD VESTING TENTATIVE MAP**

**Job Number 15956**

**April 1, 2009**

**Revised: August 18, 2009**

**RICK ENGINEERING COMPANY**

**RICK ENGINEERING CO**



*rickengineering.com*

# HYDROMODIFICATION MANAGEMENT STUDY

FOR

## MEADOWOOD VESTING TENTATIVE MAP

Job Number 15956



A handwritten signature in black ink, appearing to read "D. C. Bowling", written over a horizontal line.

Dennis C. Bowling, M.S.

P.C.E. #32838

Exp. 06/10

Prepared For:

**Pardee Homes**

6025 Edgewood Bend Court  
San Diego, California 92130  
(858) 794-2500

Prepared By:

**Rick Engineering Company**

5620 Friars Road  
San Diego, California 92110-2596  
(619) 291-0707

**April 1, 2009**

**Revised: August 18, 2009**

**REVISION PAGE FOR  
HYDROMODIFICATION MANAGEMENT STUDY FOR  
MEADOWOOD VESTING TENTATIVE MAP**

**J- 15956**

| DATE            | REVISION/ CHANGES MADE TO PROJECT  |
|-----------------|--|
| April 1, 2009   | Original submittal to County of San Diego.   |
| August 18, 2009 | Second submittal. Changes to report incorporate the June 26, 2009 County of San Diego's Plan Check Comments. |
|                 |  |

**RESPONSE TO COUNTY'S COMMENTS FOR THE  
HYDROMODIFICATION MANAGEMENT STUDY FOR  
MEADOWOOD VESTING TENTATIVE MAP**

**August 18, 2009**

Rick Engineering Company has reviewed June 26, 2009 County of San Diego's Department of Public Works plan check comments for the April 1, 2009 report titled "Hydromodification Management Study for Meadowood Vesting Tentative Map". The following text is the County's plan check comments (in italicized lettering), immediately followed by Rick Engineering Company's responses (in bold lettering).

1. *The pre-project drainage maps provided in the Meadowood Drainage Study show distinct discharge points for Drainage Basins 500, 600, and 700A/700B. For evaluating compliance with HMP regulations, it does not appear to be reasonable to combine Drainage Basins 500, 600, and 700A into a single basin, resulting in a single Point of Compliance (POC) for these basins. Instead, separate POCs are required for each of these drainage basins, as described below.*

*Drainage Basin 500. Most of the flow from Drainage Basin 500 appears to join a small tributary to Horse Ranch Creek (within the triangular area shown on the drainage maps along the western edge of the property). The approximate POC recommended for Drainage Basin 500 is shown in Figure 1.*

*Drainage Basin 600. Most of the flow from Drainage Basin 600 leaves the basin at a single discharge point. The approximate POC recommended for Drainage Basin 600 is shown in Figure 1.*

*Drainage Basins 700A and 700B. As outlined in the County's comments regarding the Meadowood Drainage Study, the delineation of Drainage Basins 700A and 700B requires reexamination. Drainage Basin 700A is currently modeled with an outlet at Node 712, while flow from Drainage Basin 700B discharges at Node 753 (see Figure 2). However, it appears from the Pre-Project Drainage Map (dated November 14, 2008) that much of the flow from 700A would actually combine with flow from 700B, with the combined flow discharging at Node 753. Therefore, a single POC could potentially be used for these two drainage basins unless significant flow actually reaches Node 712. In the latter case, two POCs would be required: at Node 753 and Node 712.*



**Rick Engineering Company's Response:** As discussed at the meeting at the Regional Board with County of San Diego, Pardee Homes, and Rick Engineering Company representatives the project is assigning the point of compliance for Drainage Basin 7000 (7000A and B combined) at the point in the system that needs to be protected rather than the project boundary. As a result the POC has been identified on the updated exhibit located in the revised report. Further discussion of this has been included in the updated text.

2. *All Point of Compliance locations should be clearly labeled on the Water Quality and Hydromodification Management Exhibit.*

**Rick Engineering Company's Response:** The exhibit has been updated to show all points of compliance associated with the project.

3. *Please revise the Water Quality and Hydromodification Management Exhibit to show the correct boundary between basins 8000A and 8000B on the east side of Horse Ranch Creek Road (i.e., it should be consistent with the Proposed Pond Locations Exhibit).*

**Rick Engineering Company's Response:** The exhibits have been updated and are included in the revised report.

4. *Please check descriptions in report text for Drainage Basins 800B/8000B, 800A/8000A, 700B/7000B, and 700A/7000A, which are listed as the second, third, fourth, and fifth drainage basins, respectively, from South to North. It appears that they should be listed as the first, second, third, and fourth, respectively, from South to North.*

**Rick Engineering Company's Response:** The text has been Updated in the revised report.

## **TABLE OF CONTENTS**

|  |    |
|--|----|
| Vicinity Map.....  | 1  |
| Project Description.....   | 2  |
| Background and Criteria.....   | 4  |
| Modeling Methodology & Criteria .....                                      | 6  |
| Drainage Characteristics and results for Hydromodification Management..... | 12 |
| Summary.....   | 25 |
| References.....  | 28 |

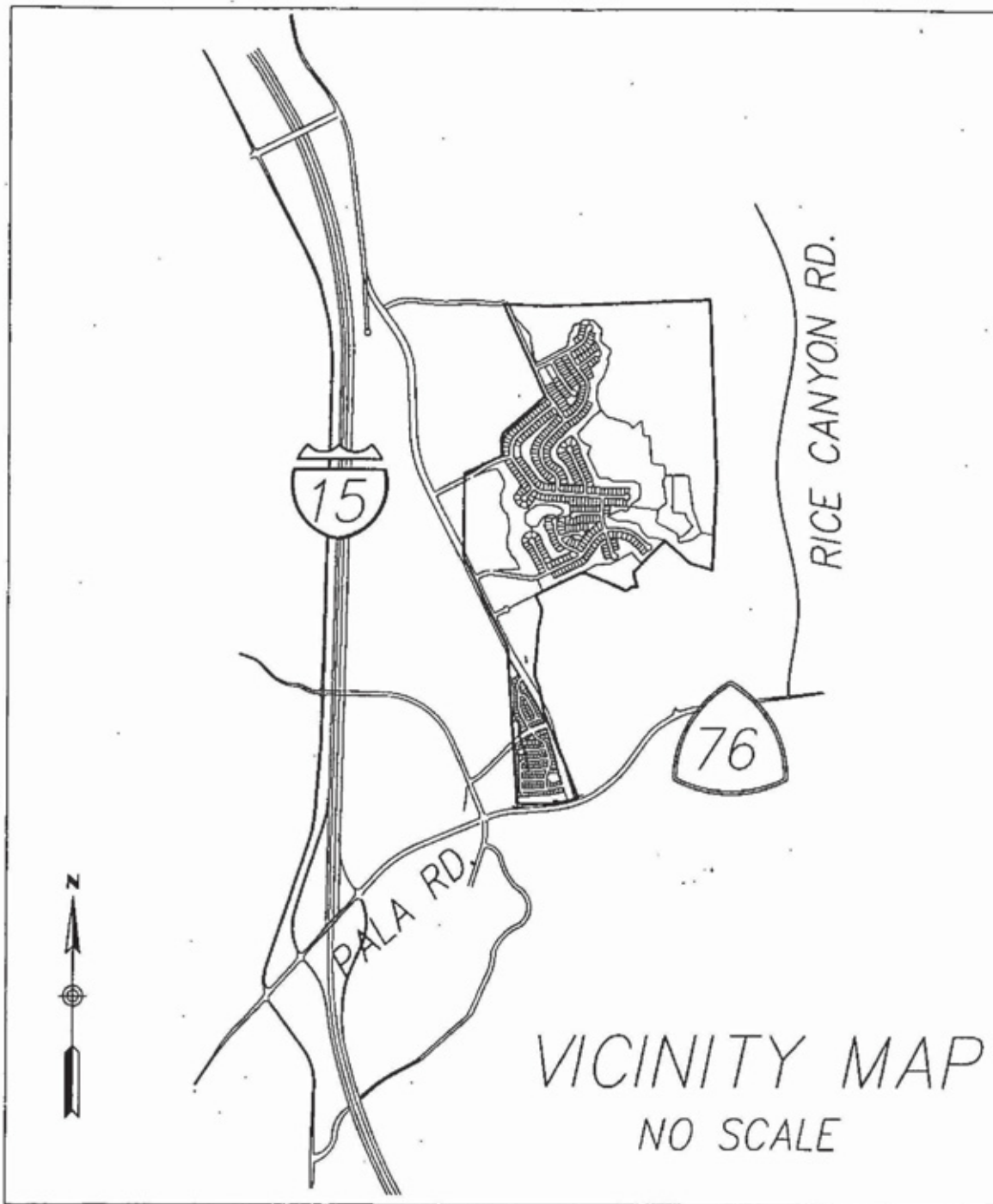
### **Appendix**

|  |  |
|--|--|
| Appendix A: Water Quality and Hydromodification Management Exhibit for Meadowood Vesting Tentative Map                 |  |
| Appendix B: Continuous Simulation Hydrological Model for Meadowood Vesting Tentative Map<br>(Electronic and Hard Copy) |  |
| Appendix C: Frequency Analysis Results   |  |
| March 30, 2009 Geocon Incorporated Letter (Planning Area 1 Infiltration)   |  |
| Rainfall Station Map   |  |
| Meadowood Pre-Project Soil Information Exhibit   |  |
| Meadowood Post-Project Soil Information Exhibit  |  |
| Meadowood Pre-Project Slope Information Exhibit  |  |
| Meadowood Post -Project Slope Information Exhibit  |  |
| Meadowood Pre-Project Ground Cover Information Exhibit   |  |
| Meadowood Post-Project Land Use Information Exhibit  |  |
| Appendix D: Summary of Drainage Basin Hydromodification Management Measures  |  |

Appendix E: Hydromodification Management Details

Appendix F: Meadowood Vesting Tentative Map – Flowpaths for Drainage Basin 7000  
Meadowood Vesting Tentative Map – POC 7A/7B and 8A/8B (Interim  
Condition)

Meadowood Vesting Tentative Map – POC 7A/7B and 8A/8B (Ultimate  
Condition)





## PROJECT DESCRIPTION

The 389.5-acre Meadowood site is located North of the State Route 76 (SR-76), otherwise known as Pala Road, approximately one-quarter mile East of Interstate 15 in the Fallbrook Community Planning Area of San Diego County, California. Currently the project site consists of orchards/trees, native shrub rural vegetation, and grassland. Pardee Homes proposes to develop approximately 218 acres (56 %) of the Meadowood site for residential and associated uses including parks, recreational trails, brush management, water tanks, wastewater treatment plant and wet weather ponds, emergency fire access road, and an elementary school. The remainder of the site will be undeveloped. This hydromodification management plan supports the Vesting Tentative Map for the Meadowood project.

The existing project site consists primarily of natural terrain and orchards. A ridge exists on the eastern half of the site, which splits the existing runoff to the East and West. The proposed development footprint of this project is entirely within the western watershed, where the natural grade directs runoff in a westerly direction towards Horse Ranch Creek, which is adjacent to Highway 15 and drains North to South. Horse Ranch Creek conveys runoff in a southerly direction and crosses State Route 76 where it confluences with the San Luis Rey River and is ultimately discharged into the Pacific Ocean.

Throughout the project, various hydromodification management measures have been incorporated into the design. These measures consist of noncontiguous sidewalks, dispersing roof flows through yards, pervious driveways (only utilized in Drainage Basin 8000A and 8000B), and "ponds"/detention facilities. Seven "ponds" and two underground vaults have been designed throughout the project to mitigate for hydromodification management. All of the ponds associated with the Meadowood project, except for one (Drainage Basin 2000), are also utilized for water quality and 100-year detention. The pond associated with Drainage Basins 2000 does not include water quality only hydromodification management and 100-year detention. The two

underground vaults associated with Drainage Basin 9000 are only sized for hydromodification management. The Continuous Simulation Hydrological Modeling (CSHM) program utilized for this project refers to the settling basins/detention basins as “ponds”. To be consistent with the CSHM, this hydromodification management plan will refer to the settling basin/detention basins as ponds and the two underground facilities as vaults herein.

As stated previously, where feasible, the “ponds” have also been designed for water quality (settling basins) and detention (detention basins). For information regarding the settling basins and/or water quality measures for Meadowood, please refer to the report titled, “Storm Water Management Plan for Priority Projects (Major SWMP) for Meadowood Vesting Tentative Map (VTM)”, dated July 22, 2009, prepared by Rick Engineering Company, herein referred to as the project SWMP. For information regarding the detention basin analysis, please refer to the report titled, “Drainage Study for Meadowood Vesting Tentative Map (VTM)”, dated July 22, 2009, prepared by Rick Engineering Company, herein referred to as the project Drainage Study.

This report describes the numerous proposed hydromodification management measures that have been designed in accordance with the County of San Diego’s Interim Hydromodification Criteria (discussed later in this text). There are seven major drainage basins discussed within the Meadowood project that are discussed in detail in this report.

## **BACKGROUND AND CRITERIA**

Hydromodification management is required pursuant to the following:

- County of San Diego's "Watershed Protection, Stormwater Management and Discharge Control and Grading" adopted by the Board of Supervisors of the County of San Diego March 12, 2008, Code of Regulatory Ordinance No. 9926 (New Series) An Ordinance Amending Title 6, Division 7, Chapter 8 and Sections 87.205 Through 87.208, 87.218 and 87.414.
- "California Regional Water Quality Control Board, San Diego Region, Order No. R9-2007-0001, NPDES No. CAS0108758 Waste Discharge Requirements for Discharges of Urban Runoff from The Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority" Dated January 24, 2007, Section D.1.g. titled, "Hydromodification – Limitations on Increases of Runoff Discharge Rates and Durations".
- County of San Diego's "Standard Urban Storm Water Mitigation Plan for Land Development and Public Improvement Projects" dated March 24, 2008.
- "Development of Interim Hydromodification Criteria," prepared by Brown and Caldwell for the County of San Diego, dated October 30, 2007.

Hydromodification refers to changes in a watershed's runoff characteristics resulting from development, together with associated morphological changes to channels receiving the runoff, such as changes in sediment transport characteristics and the hydraulic geometry (width, depth, slope) of channels. These changes result in streambank erosion and sedimentation, leading to habitat degradation due to loss of overhead cover and loss



of in-stream habitat structures. Under Section D.1.g of Order No. R9-2007-0001, the Copermittees will be required to prepare a Hydromodification Management Plan (HMP) and incorporate its requirements into their SUSMPs. As of March 24, 2008, the Interim Hydromodification Criteria are in effect.

The Meadowood project is subject to the Interim Hydromodification Criteria. Therefore, a hydromodification management strategy has been developed for the project based on the Interim Hydromodification Criteria. The project will use regional storm water management features (ponds) that were sized based on CSHM for hydromodification management, in addition to the upstream Low Impact Development (LID) measures. As shown by the computer modeling, this combination of features provides peak flow rate and duration control for the range of storms required for hydromodification management.

## MODELING METHODOLOGY & CRITERIA

A general framework for CSHM has been developed and locations for the regional and local-level storm water management features have been identified. In addition preliminary design has been performed to determine the calculated hydromodification management volumes are met, please refer to Appendix A for the locations of the proposed ponds, vaults, and upstream LID devices. Results of the volume calculations for the storm water management features are provided in Appendix B.

Currently, projects that are subject to the Interim Hydromodification Criteria are required to mimic the pre-project characteristics (with respect to duration and volumes) for 20 percent of the 5-year storm event through the 10-year storm event. The criteria further states that a CSHM analysis must be performed that analyzes these storm events. Therefore, the project utilized the San Diego Hydrology Model (SDHM) computer program to perform the CSHM. The SDHM files for the project are included in Appendix B.

The San Diego Hydrology Model (SDHM), dated February 5, 2009, was used to analyze CSHM for this project. However, due to design changes, Drainage Basin 700/7000 and 900/9000 have been analyzed utilizing a more recent version of SDHM dated March 27, 2009. The following table summarizes this information:



| <b>Drainage Basin</b> | <b>File Name</b> | <b>Date of File</b> | <b>Version of SDHM</b> |
|-----------------------|------------------|---------------------|------------------------|
| 1000                  | N/a              | Na/                 | Na/                    |
| 2000                  | Basin_2          | March 31, 2009      | February 5, 2009       |
| 3000                  | Basin_3          | March 31, 2009      | February 5, 2009       |
| 4000                  | Basin_4          | March 31, 2009      | February 5, 2009       |
| 7000                  | Basin_7AB        | August 11, 2009     | March 27, 2009         |
| 8000                  | Basin_8A         | March 31, 2009      | February 5, 2009       |
|                       | Basin_8B         | April 1, 2009       | February 5, 2009       |
| 9000                  | Basin_9_1A       | June 15, 2009       | March 27, 2009         |
|                       | Basin_9_1B       | June 15, 2009       | March 27, 2009         |

The SDHM generated flow duration curves for the pre-and post-project conditions and then sized a flow duration control pond or vault to match pre-project curves. Several input parameters had to be investigated in order to properly run the SDHM model. These parameters consist of soil type, slope, land uses, drainage basin boundaries, and rainfall data. The evaporation data is part of the SDHM calculations. The acreage for all the unique combinations of soil type, slope, and land uses, drainage basin boundaries were obtained with GIS Frequency analysis. Refer to Appendix C for Frequency Analysis Results, Meadowood Pre- and Post-project Soil Information Exhibits, Meadowood Pre- and Post-project Slope Information Exhibits, Meadowood Pre-Project Ground Cover Information Exhibit, and Meadowood Post-Project Land Use Information Exhibit.

### **Soil Type**

In the pre-project condition, the site mainly consists of Soil Types C/D in the easterly and middle portions and Soil Type B on the westerly portions. The soils information was obtained from the U.S. Department of Agriculture, Natural Resources Conservation Services, dated January 4, 2007, titled "Soil Survey Geographic (SSURGO) database for San Diego County, California". In the post-project condition, the Soil Type for the developed portions of the project was assumed to be type C/D due to fill and compaction. Refer to Meadowood Pre- and Post-Project Soil Information Exhibits in Appendix C.

### **Slope Analysis**

In the pre-project condition, the easterly portions of the project consist of steep slopes of greater than 20% and generally flow East to West. The slopes become more moderate from East to West with grades of 10% to 20% in the middle regions, 5% to 10% in the northwest and less than 5% in the southwest portion of the project. In the post project condition, the westerly portions of the project are relatively flat with grades of less than 5% through the multifamily, school site, park, and streets. The single family lots in the central portions consist of flat lots, side slopes, some manufactured 2:1 slopes, and street grades of mainly 5% to 10% and small portions of 10% to 20%. Refer to Meadowood Pre- and Post-Project Slope Information Exhibits in Appendix C.

### **Ground Cover and Land Use**

Existing ground cover for Meadowood consists of the following:

- Native shrub vegetation in the northerly and dispersed through the southerly portions of the project (Shrub was the most appropriate SDHM category for these regions).
- Orchard Trees in the central and southern portions of the project (Forest was the most appropriate SDHM category for these regions).
- Grassland along the eastern portions of the project (Grass was the most appropriate SDHM category for these regions).

This project proposes to develop approximately 56 % of the site. The proposed land use for this project comprises of single family and multi family lots, roads, noncontiguous sidewalks, parks, ponds, emergency fire access road, and a school. Refer to Meadowood Pre-Project Ground Cover Information Exhibit and Meadowood Post-Project Land Use Information Exhibit in Appendix C.

### **Rainfall Data**

Upon review of the San Diego County, Figure 1 Rainfall Station Map, included in Appendix C, it was determined that there are two rainfall stations near the Meadowood project; Fallbrook and Lake Wohlford. The Fallbrook rainfall station is closer to the Meadowood project site. However, the precipitation data trends of Lake Wohlford are more consistent with precipitation trends associated with the Meadowood location. Therefore, the Lake Wohlford precipitation data was utilized for this project. This rationale is consistent with the draft technical memorandum titled "Rainfall Station Selection Criteria", dated January 5, 2009, prepared by Brown Caldwell. The precipitation data, titled "WOHLFORD3.wdm", dated October 15, 2008, received October 16, 2008 directly from Brown and Caldwell to Rick Engineering Company was used.

### **Hydromodification Management Measures**

SDHM has the ability to process various hydromodification management measures, below are some of the measures applied to this project:

- **Noncontiguous sidewalk modeled as lateral basin-** runoff from the impervious sidewalk sheet flows onto the adjacent pervious surface, slowing down the runoff and allowing for limited infiltration prior to discharge into a conveyance system. The impervious and pervious surfaces are modeled as lateral basins. The lateral basin is similar to the standard basin except that the runoff from the impervious lateral basin goes to another adjacent pervious basin rather than directly to a conveyance system. Refer to Appendix D for summary of the drainage basin



hydromodification management measures and Appendix E for the hydromodification management details.

- **Roof runoff modeled as lateral basin-** the roof drains are not connected to the storm drain system. The roof flows are dispersed (not concentrated) through the vegetated yards. The lateral basin is similar to the standard basin except that the runoff from the impervious lateral basin goes to another adjacent pervious basin rather than directly to a conveyance system. Refer to Appendix D for summary of the drainage basin hydromodification management measures and Appendix E for the hydromodification management details.
- **Ponds-** The project proposes regional storm water management features (ponds) that were sized based on CSHM for hydromodification management. This computer modeling provides peak flow rate and duration control for the range of storms required for hydromodification management. Where feasible, the ponds are also designed to meet water quality and detention. Refer to the project SWMP and project Drainage Study respectively for the water quality and detention analyses, and refer to Appendix D for summary of the drainage basin Hydromodification Management Measures.
- **Porous Driveways –** For Drainage Basin 8000A and 8000B, the project proposes to convey the runoff associated with the lots to porous driveways. A gravel trench was utilized to model the porous driveways. Due to the soils (discussed later in this text), the infiltration option was turned on. Refer to Appendix D for summary of the drainage basin hydromodification management measures and Appendix E for the hydromodification management details.
- **Underground Vaults –** For Drainage Basin 9000, the project proposes to convey the runoff associated with the natural area east of Horse Ranch Creek Road, Horse Ranch Creek Road, the SR 76, and the sewer treatment plant to one of two

underground vaults. Refer to Appendix D for a summary of the drainage basin hydromodification management measures.



## **DRAINAGE CHARACTERISTICS AND RESULTS FOR HYDROMODIFICATION MANAGEMENT**

The pre-project node drainage basins have been assigned names utilizing in the 100's, i.e. 100, 200, 300, 400, 700A and 700B, 800A and 800B, and 900. The post-project drainage basins have been assigned names utilizing the 1000's i.e. 1000, 2000A and 2000B, 3000, 4000, 7000A and 7000B, 8000A and 8000B, and 9000. For the purpose of this hydromodification management plan seven drainage basins have been identified. Drainage basin 100 corresponds to 1000, 200 to 2000A and 2000B, 300 to 3000, 400 to 4000, 700A and 700B to 7000A and 7000B, and 800A and 800B to 8000A and 8000B, and 900 to 9000. Drainage basins 700A and 700B and 7000A and 7000B have been combined because they have the same point of compliance. Similarly drainage basins 800A and 800B and 8000A and 8000B have been combined because they have the same point of compliance. Both of these points of compliance are discussed in more detail later in this section. All of the drainage basins associated with the developable footprint for the Meadowood project are tributary to Horse Ranch Creek.

The following text describes the pre- and post project drainage basins and the results of the CSHM. Also, located at the end of this section (after the summary), is an exhibit that delineates the drainage basins, proposed ponds, vaults, and POCs.

In addition, a field reconnaissance was performed to analyze the proposed outfall locations, review the watershed, and determined the appropriate points of compliance (POCs). Based on the observation from the field reconnaissance, it was determined that portions of this watershed has already experienced hydromodification due to the existing developed agriculture areas (the existing orchards). Further discussion of this has been included in the text below.

### **Drainage Basin 100/1000 (POC 1)**

Drainage basin 100 (pre-project) is located in the most northerly portion of the project. This pre-project drainage basin is 11.2 acres sloping northeast to southwest at grades

greater than 20%. It is comprised entirely of Soil Type C/D and the main ground cover is native shrub vegetation.

Drainage basin 1000 (post-project) is 9.6 acres of undisturbed land without introducing any post-project development flows. There is a proposed street (Street D) bisecting this drainage basin. The flows from the northern portion of the proposed Street D are conveyed southerly to drainage basin 3000; therefore, no post-project flows associated with drainage basin 100/1000 commingle with the undeveloped/natural flows. Since this project is not adversely affecting this drainage basin and there is no development to mitigate for, no hydromodification management measures were proposed.

#### **Drainage Basin 200/2000A and 2000B (POC 2)**

Drainage Basin 200 (pre-project) is the second drainage basin North to South. This pre-project drainage basin is 62.1 acres. In the upstream portion of the drainage basin the slopes consists of steep grades greater than 20%. Throughout the remainder of the basin the slopes consists of moderate grades of 10% to 20% and grades less than 5% in the southwest corner of the drainage basin. The existing ground cover is mainly native shrub with a small portion consisting of an existing agriculturally developed area (orchards) in the southern parts of the drainage basin. The existing Soil Type is mainly C/D with Soil Type B in the middle regions of the drainage basin and southwest boundary of the drainage basin.

In post-project condition, this drainage basin is divided into two drainage basins; 2000A (51.0 acres) and 2000B (8.5 acres). Only 9.4 acres within drainage basin 2000A is proposed residential development, the remainder 41.6 acres (approximately 82%) will remain undisturbed/natural. The residential development consists of single-family residential lots, roads, manufactured slopes, noncontiguous sidewalks, trails, and a regional pond. The street grades are within 5% to 10% range. All developed segments are modeled with Soil Type C/D in SDHM. The noncontiguous sidewalks sheet flow onto the adjacent pervious parkways. The roof drains are not connected to the storm drain system.



The roof flows are dispersed (not concentrated) through the vegetated yard. In addition a regional pond is proposed at the southwest corner of the drainage basin. Drainage basin 2000B conveys flows of undisturbed/natural land by means of a clean water system (i.e. A storm drain system dedicated for conveying flow from natural, undisturbed area without commingling with runoff from the developed areas). The runoff associated with drainage basin 2000B does not enter the pond, only the runoff associated with drainage basin 2000A enters the ponds. However the outfalls from the pond (drainage basin 2000A) and 2000B are combined (POC 2) and are at the same location as the pre-project location. Based on information from the geotechnical engineer, infiltration was not feasible in this area.

The regional pond (DB2) is located at the downstream portion of drainage basin 2000A. This pond will satisfy the hydromodification management and 100-year detention volume (this pond does not include water quality). The required volume calculated by SDHM is 0.5 acre-ft and the actual volume for this pond is 1.7 acre-ft, refer to the project SWMP for water quality treatment and this Drainage Basin and the project Drainage Study for the volume calculation to attenuate the 100-year post-project to pre-project.

### **Drainage Basin 300/3000 (POC 3)**

Drainage basin 300 (pre-project) is 58.5 acres and is the third drainage basin North to South, sloping East to West at grades greater than 20% on the eastern portions, 10% to 20% in the middle, and 5% to 10% in the western sections. The existing ground cover consists of native shrub in the easterly portions and an existing agriculturally developed area (orchards) in the westerly regions. The Soil Types for this drainage basin consist of C/D in the eastern portion and Soil Type B in the western region.

Drainage basin 3000 (post-project) is 61.6 acres, which includes the northern part of Street D. Approximately 41% of drainage basin 3000 is comprised of undisturbed/natural land in the easterly regions of this drainage basin. The developed area for this drainage basin is approximately 21.0 acres, comprised of single-family residential lots, roads,

manufactured slopes, trails, noncontiguous sidewalks, and regional pond occupying the westerly regions. The street grades are mostly less than 5% with some areas of 5% to 10%. All developed segments are modeled with Soil Type C/D in SDHM. The noncontiguous sidewalks sheet flow onto the adjacent pervious parkways. The roof drains are not connected to the storm drain system. The roof flows are dispersed (not concentrated) through the vegetated yard. In addition a regional pond is proposed at the westerly corner of the drainage basin. Based on information from the geotechnical engineer, infiltration was not feasible in this area.

The regional pond (DB3) satisfies the required water quality treatment control, hydromodification management, and 100-year detention volume. The required volume calculated by SDHM is 3.3 acre-feet and the provided volume for this pond is 5.0 acre-feet. Refer to the project SWMP for water quality treatment and the project Drainage Study for the volume calculation to attenuate the 100-year post-project to pre-project.

#### **Basin 400/4000 (POC 4)**

Drainage basin 400 (pre-project) is 11.1 acres and is located at southwest corner of drainage basin 300, sloping southeast to northwest. The terrain shows slopes from greater than 20% in the southern portions to 10% to 20% for the majority of the drainage basin to more moderate slopes of 5% to 10% in the northern region of the drainage basin. The ground cover consists an existing agriculturally developed area (orchards). The Soil Types for this drainage basin consist of C/D in the southern and Soil Type B in the northern regions.

Drainage basin 4000 (post-project) is 11.2 acres of single-family residential lots, road, manufactured slopes, noncontiguous sidewalks, trails, and a regional pond. The street grades are 5% to 10% in the northeast to less than 5% in the southwest regions. Drainage basin 4000 (post-project) consists entirely of Soil Type C/D. The noncontiguous sidewalks sheet flow onto the adjacent pervious parkways. The roof drains are not connected to the storm drain system. The roof flows are dispersed (not concentrated)

through the vegetated yard. In addition a regional pond is proposed in the southern region of drainage basin 4000. Based on information from the geotechnical engineer, infiltration was not feasible in this area.

The regional pond (DB4) satisfies the required water quality treatment control, hydromodification management, and 100-year detention volume. The required volume calculated by SDHM is 1.1 acre-ft and the provided volume for this pond is 1.7 acre-ft, refer to the project SWMP for water quality treatment and the project Drainage Study for the volume calculation to attenuate the 100-year post-project to pre-project.

#### **Drainage Basin 700/7000 (POC 7A/7B)**

As stated previously, the POC for Drainage Basin 700A and 700B and 7000A and 7000b have been combined. The combining of these drainage basins was due in part to the existing drainage patterns in the pre-project condition and observations of existing hydromodification during a field reconnaissance.

The points/locations at which runoff from Drainage Basin 700A exit the project site and are immediately conveyed to Horse Ranch Creek. All of these flowpaths combine or confluence in the same swale. In other words each location in which runoff exits the project site and flows westerly all combine in the same flowpath/downstream waters which is located within the Horse Ranch Creek Floodplain. The swales convey these flows to a southerly location and confluence with the flows tributary to Drainage Basin 700B.

In addition, based on the results of the field reconnaissance, it was observed that there is significant erosion, existing today, located immediately downstream of the northern limits of Drainage Basin 700/7000 (this is also evident on the topographic information provided on the exhibit located in Appendix A). This active head cutting and erosion occurring is due to the fact that the majority of the northern portion of Drainage Basin 700/7000 is an existing developed agriculture area that consists of mature irrigated



orchards. While the majority of the other drainage basins associated with this project also have existing developed orchards, the evidence of hydromodification (as a result of the developed orchards) was not as evident as observed for this drainage basin. This is in part due to the topography of the drainage basin and the fact that the majority of this basin is comprised of existing developed orchards. If proposed flows associated with the Meadowood VTM were to be released in these areas, it would have an adverse impact on this watershed.

As a result of defining the flowpaths associated with the runoff for Drainage Basin 700/7000 and observations of existing hydromodification occurring today, it was determined that it is appropriate to combine Drainage Basins 700A/B and 7000A/B and assign one POC for this analysis.

Additionally, the neighboring project to the west (Campus Park), is proposing a design, immediately west of the 700A/7000A drainage basin boundary, that would be adversely affected if the Meadowood project released flows at this location.

For reference, exhibits have been included in Appendix F that delineate the flow paths and highlight this area. From the exhibits, it can be observed that the runoff from these drainage basins do in fact confluence. Also shown on the exhibits is topographic information that shows the severe erosion and head cutting that is occurring today as a result of the existing developed orchards. In addition, an exhibit has been created to show the proposed grading of the adjacent project and show that this proposed design will not impact adjacent projects (ultimate condition).

To address concerns that at the outfall location of Drainage Basin 7000A and 700B (POC 7A/7B) there may an increase in erosion between the outfall and the downstream existing waters, the project is proposing the design of a small vegetated channel with native vegetation that will safely convey the 10-year flow rate (as determined by the SDHM model) from the outfall to the downstream waters. As you can see from the exhibits, the

downstream waters are associated with the dense grove of trees located immediate west of POC 7A/7B. This grove of trees is identified as Southern Arroyo Willow Riparian Forrest (herein referred to as Riparian Forest) and from an environmental standpoint cannot be disturbed. Therefore, the proposed channel will convey the flows in a westerly direction. As the channel approaches the Riparian Forrest, it will flatten out and ultimately daylight into the existing topography. This proposed solution has been shown on both the Interim and Ultimate Condition exhibits. As stated above, the Interim Condition exhibit is only the Meadowood project and the Ultimate Condition exhibit includes the Meadowood Project and the Campus Park project. Upon final design, the channel can be designed with natural cover that can withstand the velocities and shear forces of the 10-year event as well as withstand the lateral forces occurring from the 100-Year Horse Ranch Creek Floodplain.

The following text describes the drainage basins and the results of the SDHM analysis:

Drainage basin 700A (pre-project) is 192.2 acres and is located in the central portion of the project. The general slope trend of this drainage basin is northeast to southwest with slopes greater than 20% in the eastern side, grades of 10% to 20% centrally, and grades of 5% to 10% and less than 5% toward the western boundary. The undeveloped portion of this drainage basin is comprised of existing ground cover that ranges from small sections of shrub vegetation on the northeast, central, and southern portions of drainage basin 700A. However, the majority of this drainage basin is comprised of an existing agriculturally developed area (orchards). The Soil Types for this drainage basin consist of C/D in the eastern portion and Soil Type B in the western region.

Drainage basin 7000A (post-project) is 195.0 acres. Approximately 45% of drainage basin 7000A is comprised of undisturbed/natural land. The developed area for this drainage basin is approximately 123 acres comprised of single-family residential lots, multi-family, roads, manufactured slopes, noncontiguous sidewalks, trail, park, and regional pond occupying the westerly regions. The Street grades are mostly less than 5%



with some areas of 5% to 10% and 10% to 20%. The easterly regions of this drainage basin remain undisturbed/natural. All developed segments are modeled with Soil Type C/D in SDHM. The noncontiguous sidewalks sheet flow onto the adjacent pervious parkways. The roof drains from the single-family lots are not connected to the storm drain system. The roof flows are dispersed (not concentrated) through the vegetated yard. In addition a regional pond (DB7A) is proposed in the southwesterly region of 7000A. Based on information from the geotechnical engineer, infiltration was not feasible in this area.

The regional pond (DB7A) satisfies the required water quality treatment control, hydromodification management, and 100-year detention volume. The required volume calculated by SDHM is 14.0 acre-ft and the provided volume for this pond is 20.0 acre-feet. Refer to the project SWMP for water quality treatment and the project Drainage Study for the volume calculation to attenuate the 100-year post-project to pre-project. The flows released from the pond (DB7A) are conveyed in a southerly direction to the outfall from Drainage Basin 7000B (POC 7A/7B). See exhibits for this POC location.

Drainage basin 700B (pre-project) is 43.8 acres and is located immediately south of drainage basin 7000A. The general slope trend of the drainage basin is east to West. The existing grades are greater than 20% in the eastern portion of the drainage basin and transition to more moderate grades of 5% to 10% and less than 5% as the flows travel west. The ground cover consists of shrub vegetation and existing developed agriculture areas (orchards) in the eastern regions and grassland in the western portions. The Soil Types for this drainage basin consist of C/D in the eastern and Soil Type B in the western regions.

Drainage basin 7000B (post-project) is 45.3 acres. Approximately 60% of drainage basin 7000B is comprised of undisturbed/natural land in the easterly regions of this drainage basin. The developed portion of this drainage basin is approximately 17.9 acres of school site, roads, manufactured slopes, noncontiguous sidewalks, trails, and a regional pond.

The street grades are less than 5%. All developed segments are modeled with Soil Type C/D in SDHM. The noncontiguous sidewalks sheet flow onto the adjacent pervious parkways. In addition a regional pond is proposed in the southern region of the school site, in the southwest portion of the drainage basin. Based on information from the geotechnical engineer, infiltration was not feasible in this area.

The regional pond (DB7B) satisfies the required water quality treatment control, hydromodification management, and 100-year detention volume. The required volume calculated by SDHM is 3.7 acre-feet and the provided volume for this pond is 5.1 acre-feet. Refer to the project SWMP for water quality treatment and the project Drainage Study for the volume calculation to attenuate the 100-year post-project to pre-project.

The outflows from both regional ponds (DB7A and DB7B) combine at POC 7A/7B and are conveyed in a proposed vegetated channel to the downstream waters. Refer to Exhibits located in Appendix F for reference.

#### **Drainage Basin 800A/8000A and 800B/8000B (POC 8A/8B)**

From the topographic information, it is noted that the runoff associated with both Drainage Basin 800A and 800B sheet flow and there is not a defined location in which runoff exits the project. The runoff exiting the project site in both the pre- and post-project condition, immediately outfalls into the 100-year floodplain associated with Horse Ranch Creek. Both post-project outfalls for Drainage Basin 8000A and 8000B immediately outfall into the Riparian Forrest. Based on this information, it is appropriate to combine these drainage basins and assign one POC for analysis (POC 8A/8B).

As stated above, the POC for drainage basin 800A and 800B and 8000A and 8000B have been combined. However in order to accurately size the post-project hydromodification management facilities with the SDHM model, the analyses were separated. Drainage basins 800A was analyzed with 8000A and drainage basin 800B was analyzed with

8000B. The following text describes the drainage basins and the results of the SDHM analysis.

Drainage basin 800A (pre-project) is 27.9 acres and is located south of drainage basin 700b. The general drainage trends are in an east to west direction with grades greater than 20% in the eastern portions and grades less than 5% in the western regions. The ground cover consists of shrub vegetation and an existing agriculturally developed area (orchards) in the eastern regions and grassland in the western portions. The Soil Types for this drainage basin consist of C/D in the eastern and Soil Type B in the western regions.

Drainage basin 8000A (post-project) is 26.8 acres from which 14.6 acres is comprised of residential lots and roads, occupying the western regions of this drainage basin. Approximately 47% of drainage basin 8000A is comprised of undisturbed/natural land in the easterly regions of this drainage basin. The proposed street grades are less than 5%. All developed segments are modeled with Soil Type C/D in SDHM.

Drainage basin 800B (pre-project) is 22.8 acres and is located south of drainage basin 800A. The general drainage trends are in an east to west direction with grades greater than 20% in the eastern portions and grades less than 5% in the western regions. The ground cover consists of shrub vegetation and an existing agriculturally developed area (orchards) in the eastern regions and grassland in the western portions. The Soil Types for this drainage basin consist of C/D in the eastern and Soil Type B in the western regions.

Drainage basin 8000B (post-project) is 26.1 acres from which 11.0 acres is comprised of residential lots and roads, occupying the western regions of this drainage basin. Approximately 53% of drainage basin 8000B is comprised of undisturbed/natural land in the easterly regions of this drainage basin. The proposed street grades are less than 5%



with a small portion of 5% to 10%. All developed segments are modeled with Soil Type C/D in SDHM.

Based on analyses performed by the project's Geotechnical Engineer and a letter from Geocon Incorporated dated October 14, 2008 titled "Meadowood (Pankey Ranch) San Diego County, California, Feasibility of On-Site Hydromodification", it has been determined that portions of the area associated with this drainage basin are consisting of poor soils, underlying hard granitic rock, and areas that are prone to liquefaction. As a result, the soils associated with this area will be completely removed and replaced with material that has an equivalent infiltration rate equal to 1 inch per hour. As such, the infiltration option was turned on for the SDHM analyses for this drainage basin. A letter has been prepared by Geocon Incorporated, titled, "Meadowood (Pankey Ranch) San Diego, California Planning Area 1 Infiltration," dated March 30, 2009. This letter supports the infiltration rate utilized in the SDHM analysis for Drainage Basin 8000A and 8000B. This letter has been included in this report and is located in Appendix C.

Similar to the northern drainage basins, the roof drains from the single-family lots are not connected to the storm drain system. The roof flows are dispersed (not concentrated) through the vegetated yard. However, different from the northern basins, infiltration was assumed in the driveways. The driveways will be comprised of porous material. In addition, a regional pond is proposed in the Westerly region of drainage basin 8000A and 8000B.

The two ponds (DB8A and DB8B) are proposed for this area to satisfy the required water quality treatment control, hydromodification management, and 100-year detention volume. The required volume calculated by SDHM for Drainage Basin 8000A (DB8A) is 1.1 acre-feet and the provided volume for this pond is 2.7 acre-feet. The required volume calculated by SDHM for Drainage Basin 8000B (DB8B) is 2.0 acre-feet and the provided volume for this pond is 3.7 acre-feet. The flows associated with these outfalls are immediately conveyed to the existing downstream waters. Refer to the project SWMP

for water quality treatment and the project Drainage Study for the volume calculation to attenuate the 100-year post-project to pre-project.

#### **Drainage Basin 900/9000A (POC 9)**

Drainage basin 900 (pre-project) is 21.4 acres and is the most southerly drainage basin associated with the Meadowood project. The general drainage trends are north to south with grades less than 5% in the southern portions and varying 5% to 10% and 10% to 20% in the northern regions. The ground cover consists of an existing agriculturally developed area (orchards) and the existing SR-76 road that goes through this drainage basin. The Soil Types for this drainage basin consist of B with a small portion of Soil Type A and C/D in the most southern and northern corner, respectively.

Drainage basin 9000 (post-project) is 18.3 acres. The majority of this drainage basin is comprised of natural area and the proposed sewer treatment plant. In addition, the Meadowood project is proposing to build the remaining two lanes associated with Horse Ranch Creek Road. In both the pre- and post-project condition, this drainage basin conveys flows to a dual 30 inch RCP located along SR 76. The dual RCPs convey flow from the north side of SR 76 to the south side. The RCPs outfall into an existing trapezoidal channel that is aligned on the south side of SR 76 and conveys flows westerly to Horse Ranch Creek.

For the purposes of this analysis, Drainage Basin 9000 has been divided into two subbasins. Drainage Basin 900A is the pre-project subbasin associated with the Meadowood VTM and Drainage Basin 900B is the pre-project subbasin associated with the Sewer Treatment Plant. Drainage Basin 9000A is the post-project subbasin associated with the Meadowood VTM and Drainage Basin 9000B is the post-project subbasin associated with the Sewer Treatment Plant.

The sewer treatment plant is within the project boundary, however it is not apart of the work associated with the VTM, it is associated with a major use permit (MUP). Since the

MUP and VTM approval is dependant on one another, this hydromodification management study has sized a facility within the limits of the plant that will satisfy the IHC. The facility within these limits will be maintained by the plant and not the Meadowood Home Owners Association. This facility only includes volume for hydromodification management. The plant will be responsible to implement on-site best management practices (BMPs) for water quality.

Two facilities are proposed for this drainage basin. As stated previously, one facility will be located within the limits of the sewer treatment plant and has only been designed to mitigate for the proposed plant, and the other facility will be immediately south of the sewer treatment plant and has been designed to mitigate for the Meadowood development. Both vaults have only been designed for hydromodification management only. For the on-site water quality BMPs for the Meadowood portion of this drainage basin, refer to the project's SWMP. In addition, 100-year detention is not required for either of the vaults due to the increase in flow rate was negligible (comparing pre-project to post-project) and the downstream drainage systems have capacity to convey the post-project flow rates. Refer to the project Drainage Study for the discussions regarding the 100-year storm event.

Because the Sewer Treatment Plant is not apart of the work associated with this VTM, the hydromodification analyses have been separated. The analyses associated with "Basin 9A" are associated with the Meadowood portion and the analyses associated with "Basin 9B" are associated with the Sewer Treatment Plant. The required volume calculated by SDHM for the sewer treatment plant (V9A) is 0.48 acre-feet and the actual volume is 0.48 acre feet. The required volume calculated by SDHM for the remaining portion of Drainage Basin 9000 (associated with the Meadowood development) is 0.26 acre-feet and the actual volume for this pond is 0.29 acre-feet.



## Summary

In summary, the following table provides the results of the SDHM analyses and the actual pond volumes.

| Post-Project Drainage Basin | Point of Compliance (POC) | Detention Facility Volumes<br>(acre-feet) |                            |                      |                               |                              |
|-----------------------------|---------------------------|---|----------------------------|----------------------|-------------------------------|------------------------------|
|                             |                           | Detention Facility <sup>(3)</sup>         | SDHM Volume <sup>(4)</sup> | Water Quality Volume | Volume for 100-Year Detention | Actual Volume <sup>(2)</sup> |
| 1000                        | POC 1                     | N/a                                       | n/a                        | n/a                  | n/a                           | n/a                          |
| 2000A/B                     | POC 2                     | DB 2                                      | 0.5                        | n/a                  | 0.9                           | 1.7                          |
| 3000                        | POC 3                     | DB 3                                      | 3.3                        | 1.7                  | 4.0                           | 5.0                          |
| 4000                        | POC 4                     | DB 4                                      | 1.1                        | 0.4                  | 1.2                           | 1.7                          |
| 7000A/B                     | POC 7A/7B                 | DB 7A                                     | 5.6                        | 6.8                  | 19.0                          | 30.0                         |
|                             |                           | DB 7B                                     | 3.5                        | 1.3                  | 4.2                           | 5.1                          |
| 8000A/B                     | POC 8A/8B                 | DB 8A                                     | 1.1                        | 1.1                  | 1.9                           | 2.7                          |
|                             |                           | DB 8B                                     | 2.0                        | 1.0                  | 2.8                           | 3.7                          |
| 9000                        | POC 9                     | V 9A                                      | 0.48                       | n/a                  | n/a                           | 0.48                         |
|                             |                           | V 9B                                      | 0.26                       | n/a                  | n/a                           | 0.29                         |

- (1) Upon final design all ponds will have detailed outlet work analyses, 1 foot of freeboard, and an emergency spillway.
- (2) Actual volume is the volume shown on plans.
- (3) There are two different types of detention facilities proposed throughout the project; above ground detention facilities (DB) and underground vaults (V).
- (4) Volumes are calculated utilizing the SDHM program and are for hydromodification management.



All of the ponds and vaults, with the exception of the vault located within the sewer treatment plant, will be inspected and maintained by the project's Home Owners Association (HOA). Detailed inspection, maintenance, and frequency procedures have been identified in the project's Storm Water Management Plan.







## REFERENCES

- County of San Diego's "Watershed Protection, Stormwater Management and Discharge Control and Grading", adopted by the Board of Supervisors of the County of San Diego March 12, 2008, Code of Regulatory Ordinance No. 9926 (New Series) An Ordinance Amending Title 6, Division 7, Chapter 8 and Sections 87.205 Through 87.208, 87.218 and 87.414.
- "California Regional Water Quality Control Board, San Diego Region, Order No. R9-2007-0001, NPDES No. CAS0108758 Waste Discharge Requirements for Discharges of Urban Runoff from The Municipal Separate Storm Sewer Systems (MS4s) Draining the Watersheds of the County of San Diego, the Incorporated Cities of San Diego County, the San Diego Unified Port District, and the San Diego County Regional Airport Authority" Dated January 24, 2007, Section D.1.g. "Hydromodification – Limitations on Increases of Runoff Discharge Rates and Durations".
- County of San Diego's "Standard Urban Storm Water Mitigation Plan for Land Development and Public Improvement Projects" dated March 24, 2008.
- "Minimum Criteria for Evaluation of Storm Water Controls to Meet Interim Hydromodification Criteria (IHC)," prepared by Brown and Caldwell, dated August 11, 2008 were used to meet the criteria described in "Development of Interim Hydromodification Criteria," prepared by Brown and Caldwell, dated October 30, 2007.
- "San Diego Hydrology Model User Manual" dated January 2008, prepared by Clear Creek Solution, Inc.
- "Soil Survey Geographic (SSURGO) database for San Diego County, California", dated January 4, 2007.
- Geocon Incorporated letter titled "Meadowood (Pankey Ranch) San Diego County, California, Feasibility of On-Site Hydromodification", dated October 14, 2008.

- Geocon Incorporated letter titled "Meadowood (Pankey Ranch) San Diego California Planning Area 1 Infiltration" dated March 30, 2009.
- Brown and Caldwell's "Rainfall Station Selection Criteria" Draft Technical Memorandum dated January 5, 2009.
- San Diego County's Figure 1 Rainfall Station Map from HMP TAC ftp site titled "WOHLFORD3.wdm", dated October 15, 2008, received October 16, 2008 directly from Brown and Caldwell to Rick Engineering Company.
- "Storm Water Management Plan for priority projects (Major SWMP) for Meadowood Vesting Tentative Map (VTM)", dated August 18, 2009, prepared by Rick Engineering Company.
- "Drainage Study for Meadowood Vesting Tentative Map (VTM), dated August 18, 2009, prepared by Rick Engineering Company.